

IN THE CLAIMS

Please amend the claims as follows:

1-5 (Canceled).

Claim 6 (Currently Amended): ~~[[The]]~~ A digital watermark detection apparatus according to claim 5 to detect watermark information embedded in an input image signal, comprising:

an image-size-reduction unit configured to reduce an image size of the input image signal by reducing resolution of the input image signal and to generate a size-reduced image signal; and

a detector to detect the watermark information in the size-reduced image signal, the detector including:

a correlator to compute an auto-correlation function of the size-reduced image signal;

an extraction unit configured to extract a specific frequency component signal by filtering the auto-correlation function; and

an estimation unit configured to estimate the watermark information from the specific frequency component signal,

wherein the correlator includes a controller which controls a phase of the size-reduced image signal to generate a phase-controlled image signal, the correlator computing, as the auto-correlation function, a correlation value between the phase-controlled image signal and the size-reduced image signal.

Claim 7 (Canceled).

Claim 8 (Currently Amended): ~~[[The]]~~ A digital watermark detection apparatus according to claim 5 to detect watermark information embedded in an input image signal, comprising:

an image-size-reduction unit configured to reduce an image size of the input image signal by reducing resolution of the input image signal and to generate a size-reduced image signal; and

a detector to detect the watermark information in the size-reduced image signal, the detector including:

a correlator to compute an auto-correlation function of the size-reduced image signal;

an extraction unit configured to extract a specific frequency component signal by filtering the auto-correlation function; and

an estimation unit configured to estimate the watermark information from the specific frequency component signal,

wherein the estimation unit estimates the watermark information by determining a polarity of a peak of the specific frequency component signal.

Claim 9 (Canceled).

Claim 10 (Currently Amended): ~~[[The]]~~ A digital watermark detection apparatus according to claim 9 to detect watermark information embedded in an input image signal, comprising:

an image-size-reduction unit configured to reduce an image size of the input image signal by reducing resolution of the input image signal and to generate a size-reduced image signal; and

a detector to detect the watermark information in the size-reduced image signal, the detector including:

a correlator which computes an auto-correlation function of the size-reduced image signal;

a first accumulator which accumulates the auto-correlation function for a first period of time to generate a first accumulation signal;

an extraction unit configured to extract a specific frequency component signal from the first accumulation signal;

a normalizing unit configured to normalize an amplitude of the specific frequency component signal;

a second accumulator which accumulates the normalized specific frequency component signal for a second period of time longer than the first period of time to generate a second accumulation signal; and

an estimation unit configured to estimate the watermark information from the second accumulation signal;

wherein the correlator includes a controller which controls a phase of the size-reduced image signal to generate a phase-controlled image signal, the correlator computing, as the auto-correlation function, a correlation value between the phase-controlled image signal and the size-reduced image signal.

Claims 11-16 (Canceled).

Claim 17 (Currently Amended): ~~[[The]]~~ A digital watermark detection apparatus according to claim 3, further comprising to detect watermark information embedded in an input image signal, comprising:

an image-size-reduction unit configured to reduce an image size of the input image signal by reducing resolution of the input image signal and to generate a size-reduced image signal; and

a detector to detect the watermark information in the size-reduced image signal, the detector including:

an extraction unit configured to extract a specific frequency component signal from the size-reduced image signal;

a phase controller to control a phase of the specific frequency component signal;

a correlator to compute a cross-correlation value between the phase-controlled specific frequency component signal and the size-reduced image signal; and

an estimation unit configured to estimate the watermark information from the cross-correlation value; and

an image rotation unit located before the detector and configured to perform an image rotation operation on the size-reduced image signal.

Claim 18 (Original): The digital watermark detection apparatus according to claim 17, wherein the image rotation unit comprises a line buffer to read a plurality of line components of the size-reduced image signal at a time and temporarily accumulates them, and a read unit configured to read the accumulated line components with reading portions of the line components being shifted to one another, and to supply the read line components to the correlator.

Claim 19 (Original): The digital watermark detection apparatus according to claim 18, wherein the read unit shifts the reading portions of the line component in units of a given number of pixels of the input image signal.

Claims 20-21 (Canceled).

Claim 22 (Currently Amended): ~~[[The]]~~ A digital watermark detection apparatus according to claim 3, to detect watermark information embedded in an input image signal, comprising:

an image-size-reduction unit configured to reduce an image size of the input image signal by reducing resolution of the input image signal and to generate a size-reduced image signal; and

a detector to detect the watermark information in the size-reduced image signal, the detector including:

an extraction unit configured to extract a specific frequency component signal from the size-reduced image signal;

a phase controller to control a phase of the specific frequency component signal;

a correlator to compute a cross-correlation value between the phase-controlled specific frequency component signal and the size-reduced image signal; and

an estimation unit configured to estimate the watermark information from the cross-correlation value;

wherein the size-reduced image signal has a particular reduction ratio with respect to the input image signal, and the specific frequency component signal has a frequency corresponding to the particular reduction ratio of the size-reduced image signal.

Claims 23-27 (Canceled).